Sustainability transitions and the state

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Abstract

Sustainability transitions is an emerging field of research that has produced both conceptual understandings of the drivers of technological transitions, as well as more prescriptive and policy-engaged analyses of how shifts from unsustainable to sustainable forms of production and consumption can be achieved. Yet, attention towards the role of the state is underdeveloped in the field. The significance of this neglect has become more apparent in particular due to the heightened urgency around the need to tackle climate change and energy security, where there are increasing calls for an enhanced role for the state. This paper sets out to advance understandings of the multiple and conflicting roles that states play in transitions. It first addresses key weaknesses in the way the state has been examined thus far. Second, it highlights theoretical resources and conceptualisations of the state that can help scholars of transitions open up new and more productive avenues for understanding drivers and barriers to sustainable transitions drawing on examples from different sectors, regions and issue areas.

Keywords: sustainability transitions; the state; state theory; politics; power.

1. Introduction

Large-scale, society-wide shifts in infrastructures and the provision and consumption of services and resources, as befit notions of transition and transformation, necessarily imply a key role for the state. Despite years of neo-liberal ideological assault on the efficiency and effectiveness of the state in Europe and North America and the global South through the influence of global economic institutions such as the World Bank and IMF, the role of the state is being reconsidered both in policy circles and by researchers studying approaches to sustainability transitions (Grin et al 2010). There is a growing recognition that from protecting niches, nurturing research and technological innovation through to industrial policy, regulation and enforcement, the range and depth of powers that only the state can call upon will be required if radical and rapid transitions are to be achieved which allow humanity to operate within planetary boundaries (Rockstrom et al 2009). This recognition has reinvigorated debates about the state and environmental crisis, drawing on earlier contributions around the prospects of a green state (Barry and Eckersley 2005; Eckersley 2004).

The role of the state has been discussed more narrowly in economic approaches to key sustainability challenges such as climate change. Here the emphasis is on the role of the state in enforcing property rights to enable trading, establishing pricing mechanisms and articulating minimum standards, where a theory of the state tends to be implied rather than articulated (Grubb 2013; Stern 2007). Instead, a set of normative recommendations are proffered about what a 'night watchman' state should do to achieve 'optimal policy outcomes' (Mabey et al 1997) assumed to be achieved by facilitating the smooth running of a self-regulating market. Neo-institutional and evolutionary economics approaches meanwhile allow for a greater appreciation of the active and potentially positive role of the state in shaping policy outcomes (Jacobs and Mazzucato 2016). The state is also being brought back through the renewed attention to 'industrial policy' where the state plays a more active role in directing policy instruments towards addressing 'market' and 'coordination' failures as part of a more long-term strategy to support industry (Aiginger 2014; Bianchi and Labory 2011; Pegels and Lütkenhorst 2014; Peneder 2016; Stiglitz et al. 2013). However, most accounts stop short of furnishing an explanation for how and why states behave the way they do, less still with regard to processes of transition with which we are concerned here.

In the burgeoning field of sustainability transitions more specifically, the state has been implicitly acknowledged, through increasing focus on politics and power (Geels 2014), incumbency (Smink 2013), institutional perspectives (Lockwood et al 2016) and a focus on the destabilisation (Turnheim and Geels 2013) and discontinuity of regimes (Johnstone and Stirling 2015). While themes related to the state are becoming a more central focus in sustainability transitions, understanding the state as a focal point of analysis – as opposed to broader institutional account of

decision-making – remains understudied. There is a need to further understand not just the role of a state, but also to delve deeper into the nature of the state in different contexts in more relational terms. Our focus is not normatively on whether the state is a good or bad thing and what its role should be, but rather on developing understandings of the state from diverse literatures to enrich understandings of sustainability transitions. What we provide here then is not a neat multi-dimensional conceptual model of the state that can be applied as a whole to case studies of transitions. Rather, we outline a framework for understanding different aspects of state power and ways of thinking about the state that can be adapted and selected according to their relevance by transition scholars to understand the sector, region and period of time they are studying.

After reviewing discussions of the state in sustainability transitions thus far, we introduce five themes and the literatures which address them. These literatures and themes afford a more multi-faceted and inter-disciplinary reading of the state drawn from political economy, international relations, innovation studies, development studies and geographical perspectives. First, we discuss *historical* understandings of the functions and capabilities of states. Second, we focus on *global and spatial* readings of state-society complexes, given the diverse geographies of statehood that exist around the world. Third, *multi-dimensional* understandings of the full range of state power and functions that might be pertinent to their role as agents of transition and transformation beyond the realm of technology policy are outlined. Fourth, we discuss more *relational* and less zero-sum and static notions of power than are often ascribed to the state, enabling an appreciation of the state's embeddedness in particular social relations. Fifth, we consider the *material* characteristics of technologies and how commitments to certain technologies may (re)produce particular types of decision making and require particular types of state; but also how the institutional configurations of the state may benefit or inhibit certain forms and uses of technology. We argue that these approaches offer an important resource for developing understandings and pursuing new avenues of research about the processes through which diverse configurations of the state are constituted. With the state becoming an increasingly important point of reference in the literature, these insights will offer a useful resource for research on key current themes in sustainability transitions including understanding politics and power in transitions, accelerating transitions, as well as fostering understandings of why transitions proceed along very different trajectories in different transitions contexts.

The rest of this article proceeds as follows. Before drawing upon relevant insights from a range of literatures on how to theorise and comprehend state practices, we first summarise some of the ways in which the state is currently conceptualised in the literature on socio-technical transitions in section 2. We outline how although there has been implicit recognition of the crucial role played by the state in sustainability transitions, the state has not for the most part been examined as a focal point of enquiry in those debates. Section 3 outlines the five perspectives on the state, drawing on conceptual resources that help us to understand what we argue are key, yet neglected, dimensions of the state in socio-technical transitions. In the concluding discussion, we return to the broader implications of these insights for the field of sustainability transitions more generally and future research on the state in particular.

2. The state in sustainability transitions

2.1 The implicit presence of the state in sustainability transitions

Sustainability transitions is a burgeoning field of research that seeks to understand how transitions from unsustainable to more sustainable systems across a range of sectors including energy, transport, food and water can be initiated, as well as working with policy actors to implement such changes (Markard et al. 2012). There are varied strands to this work including insights from evolutionary economics (Dosi 1982; Hughes 1989; Nelson and Winter 1982), technology studies (Bijker 1997; Latour 1996), and structuration theory (Giddens 1984). Particularly prevalent in this literature has been the development of the 'Multi Level Perspective' (MLP) (Geels and Schot 2008).

The MLP focusses on the interactions between 'niche', 'regime' and 'landscape' levels in understanding how incumbent (and unsustainable) technological regimes can be 'destabilised' through 'niche' developments. Niches refer to protected spaces including new innovations, technologies, actor configurations and institutional

arrangements that replace and transform technological systems in energy, food, transport, and water, as part of transitions to sustainability (Geels 2002; Kemp 1994; Kemp et al. 1998). Traditionally, most research utilising the MLP has been focussed on the 'focal regime configuration' entailing niche-regime dynamics (Johnstone and Stirling 2015). The 'landscape' level, that refers to a range of 'exogenous' factors to the focal regime configuration – including the state – has generally remained a secondary concern. Geels and Schot (2007) refer to 'internal' factors of a socio-technical regime and niche in which the primary focus remains on the economics, institutions, cultural rules and norms of the interactive focal configuration of niche and regime. 'External' (and usually secondary) concerns of the 'landscape', refer to a very broad range of factors including other institutional perspectives (such as 'varieties of capitalism'), political and cultural contextual factors or how 'paradigms' differ between national contexts (Kern et al. 2014). Other factors also included in the landscape can include phenomena ranging from 'protest' movements (Schmitz and Scoones 2015) 'long-range' economic or environmental change, to unpredictable 'shocks' like financial crises or disasters such as a major accident (such as the Fukushima nuclear disaster in 2011) (Geels 2013). In short, the landscape level is conceived of in an incredibly broad manner, yet has only been critically interrogated in a limited manner (Newell and Bulkeley 2016).

In accounts of the protection and nurturing of sustainable niche developments, 'the state' is often mentioned in terms of its crucial role in providing regulatory functions that protect and nurture niches (Nill and Kemp 2009; Raven,2005; Schot and Geels 2008; Smith 2007; Smith et al. 2013; Witkamp et al. 2011), as well as creating markets for new niche innovations (Jacobsson and Lauber 2006). In explanations of niches, past examples often include references to developments that would have been impossible without strong (and often fairly undemocratic) state protection, such as niches developed by the military (Geels 2002). More recently, policies often cited include Feed-in-Tariffs for renewables in the energy sector that represent state interventions in markets and are the consequence of political struggles to gain and execute state power. For example, the landmark German Feed-in-Tariff was in part a consequence of a 'red-green' coalition, highlighting the important role binding decisions made at the state level can play in advancing energy transitions. The importance of an electoral system, which makes it possible for such a political coalition to gain power, is also highlighted by the case of the German energy transition (Kuzemko et al 2016). Such concerns are often secondary to the main focus on how niches were developed. In short, within sustainability transitions literatures 'the state' has been an assumed but under-conceptualised, secondary aspect in explorations of socio-technological transitions and niche development.

The broader ideological context in which sustainability transitions literatures emerged in the mid-1990s is significant. This was an era characterised by a notable shift from 'government' to 'governance' (Rhodes 1996), where a variety of concepts including 'reflexive governance' and 'horizontal governance' emerged. Such notions encapsulated the idea that the state was but one actor amongst many, *primes inter pares*, and were in part, underpinned by the ideological preference for the 'hollowing out' (Rhodes 1994) and 'retreat' of the state (Strange 1996). Here, the democratic potential of transitions arenas was thought to lie *outside* the formalised institutions of the state (Jhagroe and Loorbach 2014).

Early notable interventions did, however, highlight the lack of analysis of the state and the significance of this given that the state provides "…a critical mechanism for taking collective decisions, giving effect to collective choices and mobilising societal resources for societal ends" (Meadowcroft 2005: 494). These calls are arguably more relevant now owing to developments in both sustainability transitions literatures and the policy sphere that require a clearer understanding of the nature and role of the state. This includes the 'political turn' in transitions, a focus on incumbency and the regime in transitions, emerging perspectives and new policy challenges related to phase out, destabilisation and discontinuation, as well as institutional and contextual perspectives on sustainability transitions. We discuss these trends in the following section.

2.2 Towards the state in sustainability transitions: incumbency, politics power and 'flip-sides' to innovation

In this section we briefly outline different themes that have emerged in sustainability transitions literatures in recent years that have expanded the traditional primary focus around the support and promotion of niches to look at the regime level and contextual factors, addressing issues of politics, incumbency, and destabilisation. These emergent areas of concern in sustainability transitions literatures point to the need to further develop understandings of the nature and role of the state. These themes overlap to some extent, but are presented below to give an idea of key policy and conceptual concerns that could benefit from developing insights related to the nature of state. In section 3 we go on to highlight how the themes below could benefit from different perspectives on the state from geographical and political economic literatures, further refining understandings of sustainability transitions.

2.2.1 The political turn and the need to accelerate sustainability transitions

The fact the state is attracting increasing attention among sustainability transitions scholars is apparent in the theoretical turn towards understandings of politics and power in transitions in recent years (Geels 2014; Scoones et al 2015). The increasing focus on power is relevant in considering the nature of the state within sustainability transitions, as a theory of the state fundamentally relates to theorisations of power in society. Indeed the state is often regarded as being the interface between society and economy within political theory more generally (Weber 1978). There is also the empirical reality that desired change is not taking place at the rate that scientific assessments of climatic change, crises related to food and water and so on, suggest they should be, underscoring the need for more radical transitions in shorter timeframes (Fouquet 2016; Kern and Rogge 2016; Weyant 2011). The need for an executive authority to make binding decisions that cannot be made by the market or non-state actors entails a key role for the state in sustainability transitions (Grin et al 2010). Further themes within the overall context of more attention towards politics and accelerating transitions are discussed below.

2.2.2 Incumbency and regime resistance

It has been recognised for some time that there has been an over-emphasis on niche developments, and that accelerated transitions will have to tackle the dynamics which sustain the stability of unsustainable socio-technical regimes (Geels 2011; Geels and Kemp 2007; Raven et al. 2015; Smith and Stirling 2010; Smith et al. 2010; Turnheim et al. 2015;). Efforts to instigate sustainability transitions do not proceed at the pace and in the manner planned for because incumbent fossil fuel companies and other actors have captured the terms of debate about how best to manage the transition to a low carbon economy. More ambitious goals around the development of renewables and other low carbon innovations may be curtailed as a result, because they pose a threat to the existing regime configurations such as the business models of leading incumbent utility companies (Hendriks and Grin 2007; Kemp et al. 2007; Kern and Smith 2008; Smink 2015; Verbong et al. 2008). Understanding the political tactics of incumbents (Smink et al 2013), and processes of 'regime resistance' (Geels 2014) have illuminated how regime stability that slows the pace of transitions is achieved through the strategies of incumbents.

It is increasingly recognised that it is through coalitions and relations with state institutions that incumbency is maintained and radical transitions are inhibited (Aklin and Urpelainen 2013). The effects of coalitions between incumbents and the state and political lobbying of the state are being recognised as a key means through which the directionality of particular transitions is shaped (Geels 2014; Hess 2014; Smink et al. 2013; Sühlsen and Hisschemöller 2014). Further developing understandings of the state can usefully expand such accounts, in interrogating how the nature of different states enables or inhibits the political capture of governance processes.

2.2.3 Destabilisation and discontinuation in transitions

Another related area of attention has been on various 'flip sides' to innovation, where it is not just the promotion of niches at stake, but rather the need to weaken the regime in order to bring about more rapid transitions and make space for new innovative sustainable technologies to develop. This includes a focus on 'destabilisation' (Turnheim and Geels 2013; Turnheim and Geels 2012), and re-visiting 'policy mixes' to include both 'creative' niche-

supporting 'motors of innovation' as well as 'destructive' regime-weakening policy instruments (Kivimaa and Kern 2016; Rogge et al. 2015; Rogge and Reichardt 2013;). More deliberate 'discontinuation' processes have also become a recent focus including the phasing out of dominant technological trajectories (Bergek et al. 2013; Johnstone and Stirling 2015; Stegmaier et al. 2014). This work in sustainability transitions is not just of conceptual interest. The phasing out of unsustainable technologies is increasingly identified as a key priority at the policy level (Caldecott et al 2017; DECC 2016; European Commission 2015; Tomesco 2016; Schulz and Schwartzkopff 2015). The importance of understanding the state here is clear in that enacting a deliberate decision and timeline to phase out a particular industry and promote accelerated transitions will inevitably rely heavily on state institutions in a way that the promotion of niches does not necessarily require. The need for governments to exert authority over market actors to initiate more rapid transitions through controversial measures such as phase out policies and directly intervening in markets is seen as a key priority (Sovacool 2008).

2.2.4 Contextual and institutional perspectives on transitions

Literatures on sustainability transitions have increasingly drawn on comparative and more geographically sensitive approaches. Such approaches highlight the varied institutional contexts which give rise to very different forms of decision making and power asymmetries influencing sustainability trajectories in myriad ways (Coenen et al. 2012; Hansen and Coenen 2015; Longhurst 2015; Murphy 2015; Sengers and Raven 2015). Increasing focus is placed on the 'embeddedness' of socio-technical regimes in contextual 'deep' factors that might include differing aspects and forms of the state apparatus and institutions (Andrews-Speed 2015; Farla et al. 2012; Fuenfschilling and Truffer 2014; Lockwood 2015; Kuzemko et al 2016). Focus on the political economy of transitions in particular contexts (Baker et al. 2014; Newell and Phillips 2016; Power et al 2016), including 'political coalitions' that span government institutions and industry (Hess 2014; Jacobsson and Lauber 2006) has also drawn more attention to the nature of the state. Additionally, perspectives focussed on how state intervention strategies differ in terms of 'varieties of capitalism' (Ćetković and Buzogány 2015; Hall and Soskice 2001; Kuzemko et al. 2016), 'policy paradigms' (Kern et al. 2014), and 'qualities of democracy' (Johnstone and Stirling 2015), serve to highlight key differences between sustainability transitions in different contexts. Attention towards the differing ways in which states act or do not act with respect to market intervention, is a crucial element in understanding the differences between transition contexts. Yet it is important to focus in more depth on the differing processual dynamics that constitute the state in these differing contexts.

2.2.5 The need to further develop understandings of the state in sustainability transitions

While useful, the accounts discussed above, fall short of a broader and more relational account of the role of the state in transitions at this historical conjuncture. Analysis remains at a fairly static and abstract level, in terms of categorising particular contexts in relation to the roles that states might perform. Strict dividing lines often persist in relation to 'state', 'market' and 'civil society', and while the importance of understanding processes of restructuring through 'rescaling' has been recognised (Hansen and Coenen 2015), the processual and dynamic nature of the state in configuring geometries of power between different actors (Cohen and McCarthy 2014; Lobao et al. 2009; Johnstone 2014) remains largely unexplored. There is a need to further understand not just the role of a state, therefore, but also delve deeper into the nature of the state in different contexts, in more relational terms that opens up the processes which (re)produce the assemblages of the state. Insights drawn from Geography and (international) political economy in particular can help to develop more insightful and richer understandings of the state within sustainability transitions. To illustrate this potential, different perspectives on the role and nature of the state are explored in the next section and illustrated through examples of the practice of different transitions to sustainability.

3. Enriching understandings of the role of the state in transitions

Current understandings of the state in thinking about socio-technical transitions offer a useful, but ultimately somewhat partial, understanding of the role of the state in enabling as well as frustrating socio-technical transitions and broader societal transformations. These accounts shed useful light on specific managerial and regulatory

functions of the state in ordering a regime, or given the focus on creating and nurturing niches (such as with SNM), express an interest in the potentially positive role for an entrepreneurial state (Mazzucato 2013). However, there are many other dimensions of state power that are relevant to understanding the capacity, inclination and scope for progressive state involvement in transitions which remain neglected. It is these dimensions we explore in this section of the paper.

3.1 Historical understandings of the state

First, we emphasise the importance of an *historical* understanding of the role of the state in transitions since the form, function and capacities of states with regard to regulation, innovation, finance and production evolve continually in relation to shifting societal needs and ideological currents. This builds on, but is distinct from, attempts by transition scholars to look at the histories of transitions in narrower terms of histories of technological innovation and uptake, or around particular socio-technical configurations (Allen 2012; Fouquet and Pearson 2012). Going beyond tracing the history and evolution of particular policy interventions, the emphasis would be on how particular approaches to and ideologies of regulation are circumscribed by the broader political economy in which they are evolving, as well as seeking to re-shape. The marketization of environmental governance (Newell 2008) in many spheres in which transitions are unfolding would be an obvious case in point. The entrenchment of neo-liberal ideology from the mid-1980s onwards in key states and institutions of global governance has played a major role in discrediting the role of the state in sectors such as energy, water and food provision. This entrenchment is manifest in waves of water privatisation, power sector reform and global alliances to lever private sector capital into agricultural markets such as the New Alliance for Food Security and Nutrition focussed on Africa, for example, as well as the preference for Public-Private Partnerships and private governance (Pattberg 2007).

What this historical analysis of the state also brings to the fore, therefore, is shifts in the form and functioning of the state over time. For example since the 1980s there has been a shift in the purposes and nature of state policy in the global economy towards what Cerny (1990) refers to as the 'competition state'. Here, 'forms of state economic intervention – or, in its broader form, the economic and social activities of the state (. . .) – [change] in the attempt to respond to, and to shape and control, growing international economic interpenetration and the transnational structures to which it gives rise' (Cerny 1990: 230). Critical scholars of International Political Economy also argue that the structural power of capital has been enhanced by increased mobility which allows transnational corporations to discipline those states whose policy measures they disapprove of (Gill 1995). Documented examples of this in the environmental realm include repeated threats by transnational firms to relocate in the face of carbon taxes and other policy measures that jeopardise their privileged position (Newell and Paterson 1998). Awareness of this structural power, whether exercised or not, is often invoked to resist transitions away from fossil fuels on the basis that if a country is over-ambitious in its climate policy, capital will re-locate to areas of the world where carbon is not subject to regulation. This was the rationale invoked by the Bush government in the US for not signing the Kyoto Protocol and is a fear played on by groups such as Business Europe and the European Roundtable of Industrialists to check embryonic policy developments of which they disapprove. This broader context is, therefore, important for understanding how domestic choices are opened up or closed down because of their relation to wider configurations of political and economic power.

What political economy accounts of the state also lend to transition studies is an understanding of the broad social relations of power within which the state is situated and which characterise the historical development and consolidation of particular state-society complexes. Research in South Africa, for example, shows how a powerful Minerals-Energy-Complex (MEC) provides a useful way of understanding what STS scholars would understand as the power of incumbents to resist shifts in policy threatening to their material interests because of their embeddedness in networks of institutional power (Baker et al 2014). The MEC refers to: 'a regime of accumulation based on low-cost state-owned electricity production (via Eskom) and cheap labour, the incorporation of Afrikaner political power into the mining sector under apartheid and the rationalisation of finance houses, since converted into large-scale national and international corporate capital, tightly bound to energy and mining capital' (Baker et al 2014:7). This structure of power, organised around a particular regime of accumulation, is not about the policies

or positions of one government. It reflects the deep dependence of the state upon particular modes of accumulation for securing its legitimacy and retaining power, ones which in this instance are often juxtaposed with the need to wean the economy off fossil fuels. This is used to explain the power accrued by parastatals such as Eskom to control market access for independent power producers wanting to generate renewable energy in order to preserve its incumbent position (Baker et al 2014).

This is not to imply a static notion of fixed interests, but rather shifting historical alignments of actors and networks vying for the state's support. In this regard Marxist political economy also helpfully explores the competition between different fractions of capital, a reference to the different functions of capital – such as finance, production and the different forms capital takes as it circulates. Since the goal of a capitalist state in a global economy is to (re)produce the conditions of capital accumulation (Jessop 1990; Miliband 2009) different fractions of capital compete to project their sectoral interests as compatible with those of capital-in-general and therefore coinciding with core state objectives. Newell and Paterson (1998) developed this analysis in relation to the role of fossil fuel interests in resisting more ambitious action on climate change based on claims of their privileged role in enabling growth because of the intimate relationship between energy and growth. Scope for state autonomy remains, but there is a recognition that the state has to negotiate with a shifting balance of class and social forces including labour and capital whose power waxes and wanes depending on broader shifts in the global political economy, as well as the social base of the governing classes at a particular conjuncture (Poulantzas 2014).

What is also notable is that the power of different types of capital shifts over time in line with perceptions about how best to secure growth in a dynamic global political economy, with implications for the role of the state. In broader historical terms, Regulation theorists refer to the relationship between 'regimes of accumulation' and 'modes of regulation' (Aglietta, 2000). The concept of 'regimes of accumulation' refers to the way in which production, circulation, consumption, and distribution organize and expand capital in a way that stabilizes the economy over time. The modes of regulation required to stabilize these regimes include the law, state policy, corporate governance and cultures of consumption. For example, in a finance-led regime of accumulation, such as is said to characterise today's global economy and has done so since the 1970s, state responses to environmental crises are expected to produce solutions which benefit finance capital. The continued drive towards carbon trading, despite its poor performance to date, and the creation of derivatives in food and weather can be understood in this light. Likewise the strategic targeting of financial actors by shareholder activists, divestment campaigners reflects a reading of where power lies and might be mobilised to unsettle the incumbent regime (Newell and Paterson 2010). If restless finance capital is the key to technological revolutions as Carlota Perez's work suggests (2002), the state's relationship to finance capital has to be the centre of analysis.

3.2 Global and spatial analysis of the state

Secondly, accounts of the role and nature of the state in transitions would benefit from a more *global* and *spatial* analysis. This means re-embedding the state within networks of power normally associated with the landscape; appreciating where global shifts such as those described above in relation to globalisation, for example, have reconfigured state autonomy and recognising the power of global institutions to influence the form and direction of transition pathways across the globe. As well as showing how some states have a huge bearing upon the course of transitions in other countries, literature in Development Studies and International Political Economy (IPE) also shows how the 'policy autonomy' and 'developmental space' (Gallagher 2005; Wade 2003;) of countries to pursue their developmental goals in the energy as in other sectors, can be circumscribed by their dependence on aid or trade relations with more powerful public and private actors (Power et al 2016). Within Africa, for example, the role of the state needs to be located within broader shifts towards 'electric capitalism' (McDonald 2009) and the waves of power sector reform initiated by the World Bank. These reforms set the terms of transition across Africa along neo-liberal lines by unbundling public control over the generation and distribution of electricity for example and putting it out to private tender (Newell and Phillips 2016).

Conversely, some states, either directly though their foreign policy, or indirectly through financing and control of international institutions, have a disproportionate impact upon the nature and scope of transitions elsewhere in the world. Conceptualising this configuration of power with reference to generic 'landscape' factors does not provide

us with an adequate basis for comprehending the configuration and uneven impact of that landscape. For example, global institutions such as the World Bank, over whom the US exercises vast influence though funding and voting rights, have played a key role in shaping the direction and nature of transitions in countries to which they lend (Tellam 2000). Newell and Phillips (2016) have shown in the context of Kenya, bilateral and multilateral donors, have privileged market-led solutions achieved first through power sector reform programmes, and latterly though support for particular low carbon pathways. Such activity has levered openings for foreign investors and reduced the state's role to one of facilitating private investment while absorbing the key financial risks up front, as witnessed through the creation of a Geothermal Development Corporation in the country to undertake surveys and prospecting.

Extending the argument about the need to 'globalise' the study of transitions in relation to the state still further, how much scope states have to transition from one energy system to another will depend greatly on how far through commercial, or sometimes military means, they are able to meet their energy, food or water needs overseas. For example states can alleviate pressures to transition domestically by meeting their current and future energy needs through sourcing resources globally. Energy statecraft and commercial diplomacy through to more coercive foreign policy interventions including war (Yergin 2009) can be employed by powerful states to achieve geo-strategic state energy goals in ways which reduce pressure for domestic transitions in energy and other socio-technical configurations. There is a long history of more powerful states intervening on behalf of their incumbent energy companies in the face of nationalisations or political revolutions, such as the UK's interventions in Iran on behalf of British Petroleum. There is also of course an *inter*-national dimension to geo-political competition and the extent to which shifts in the balance of power in the international system, most recently the growth of so-called 'rising powers', has reconfigured global resource politics, including impacts on energy transitions in parts of the global south (Power et al 2016). The prospects of transitions to sustainability are affected by these global interdependencies and the ability of powerful states to alleviate pressures for reform when faced with resource constraints through outsourcing, displacement or securing desired resources elsewhere through combinations of diplomacy and coercion. Approaches such as these might be considered to be too far removed from the more discrete endeavours of states to re-assemble socio-technical configurations in particular settings. Yet in a highly inter-dependent global economy where capital, social movements and regional and global institutions reconfigure sites of politics and policy without respect for sovereign borders, networks, and inter as well as intra-national flows of power need to assume a more central place in accounts of transitions. The state then is one node within a wider web of power which it shapes and is shaped by, consistent with the relational account we are developing here.

3.3 Multiple dimensions of state power

Thirdly, we argue that accounts of the role of the state in transitions need to embrace the multi-functionality of states and the *multiple dimensions* of state power. It is notable, for example, that the role of the military establishment is often absent in theorisations of transitions despite fairly frequent references to the 'niche' established by the army; whereas in most classic conceptions of the state, a monopoly on the use of force is highlighted as a core state function and privilege. Militaries are the means by which state's energy foreign policies are sometimes pursued, as well as being among the largest consumers of fossil fuels and, therefore, part of the incumbent regime in many parts of the world. Military expenditure often constitutes one of the largest demands on state finances and the often symbiotic relationship between energy and military regimes and complexes has led many scholars to propose the existence of a military-industrial complex (Koistinen 1980). The networks of funding and patronage that bind together universities and industry, technology providers (Kloppenberg 2005) and the military require a more relational and networked understanding of the role and autonomy of the state. Many of these actors are the 'street-level bureaucrats' (Lipsky 1980) of transitions whom the state seeks to steer and align, but over whom full control is not exercised and where power and dependency run in multiple directions. For example, given the close interrelationship between civilian and military uses of nuclear energy, it is not surprising that military actors play a critical, yet often under-acknowledged role in setting the direction and pace of transitions (Cox et al 2016; Johnstone and Stirling 2016).

It is also the case that studies of transition often focus on policies and initiatives emanating from ministries of environment, science and technology and not the ways in which policies pursued by often more powerful ministries of trade, industry and finance reinforce a competing, and often less sustainable, pathway. In other words 'non-environmental' policy regimes will often be more decisive in determining, and often undermining, the effectiveness of policies pursuant of transitions to sustainability (Newell 2008). A more holistic account of the multiplicity of sites of power and drivers of transition across the state is thus required.

3.4 Relational understandings of the state

Fourthly, we need a *relational* account of the state. Drawing from critical political economy literatures, a key point of departure would be to avoid fetishizing the state as a political and institutional configuration abstracted from broader social and economic relations that characterise the economic system in which states are situated and within which they have to compete with one another. From this point of view the state is not seen as a separate sphere with its own logic, not "suspended in mid-air" as Marx noted, but giving form to economic institutions and production relations (Marx, 2005). This is significant because who sets the terms of transition and how, is often a product of broader configurations of social, economic and military power that are crystallised in the state in particular patterns of representation and privileged access to decision-making. However, such factors cannot be reduced to those expressions within *government* and the executive branch of the state alone. Such understandings draw on a long lineage of critical scholarship which draws attention to social power within the state and in society, often traditionally understood in class terms (Jessop 1990; Miliband 2009; Poulantzas 2014) or with reference to a broader power elite (Mills 1956). In this account "The executive of the modern state is but a committee for the managing of the common affairs of the whole bourgeoisie" (Marx and Engels 1998: 82). The law then as a means of managing and steering transitions is not neutral, a mere tool of regulation, but rather embodies and reinforces particular class interests: the social relations within which law is cast and which it serves to entrench. Much of the environmental justice literature draws on these insights about the class and other social biases (racial, gendered, and ethnic) that are entrenched, protected and upheld by the law regarding siting decisions and planning procedures for industrial projects or infrastructural investments (Cole and Foster 2001), as recent resistance by indigenous peoples' movements to the XL and Dakota pipeline projects in the US make clear. Scholarship such as this suggests the need to be attentive to the social power of the state, reaching out into civil and political society in order to understand the prospects and limits of radical and disruptive change to incumbent regimes. This broader notion of the state, where the media, church and other institutions are part of the outer fortresses of an extended state resonates with Gramscian understandings which have been applied to energy, food and water politics (Ekers et al 2013; Wainwright and Mercer 2009). Such accounts help understand how hegemonic control over particular pathways can be maintained across material, institutional and cultural spheres of power (Levy and Newell 2002).

Addressing who the state serves and which interests it seeks to protect is vital to assessing the prospects of more radical and progressive interventions imagined in much transitions scholarship. For example, the close relationship between energy and growth means that energy politics always represents high politics, affording large providers of energy a degree of structural power in state decision-making which they have exercised repeatedly in climate change politics (Newell and Paterson 1998). But other sectors where transitions are being called for and attempted around agriculture, water, transport and housing are also ridden with incumbent interests and contentious politics where redistributive reforms in access and the provision of infrastructures are fiercely resisted by incumbents (Bakker 2010). Research on episodes of re-ordering the water sector shows how the shifting class politics of the state can dramatically reverse regimes of ownership and access where in Argentina and Bolivia, for example, privatisations have been reversed and in Uruguay an amendment made to the constitution prohibiting the privatisation of water (TNI 2005). Beyond electoral politics, states in many parts of the world are reliant on building and then serving their social base. Two examples are the campesino and indigenous groups in Evo Morales's Bolivia, which lead to the land reform and the nationalisation of energy industries around a discourse of energy and food sovereignty (Crabtree 2005), and the consolidation of land and control over labour through the promotion

of biotechnology for crops in countries such as Argentina (Newell 2009). Such social relations strongly configure the prospects of new technological innovations or niches unsettling as opposed to reinforcing dominant regimes.

3.5 Material accounts of the state

Fifth, it is important to recognise the material implications different technologies have, and how this impinges on the institutional practices of the state. The characteristics or materialities of 'technology' contribute to the (re)production of different forms governmental practice or governmentalities. Work by Barry highlights how, as well as state power being articulated in a territorial sense, states are also constituted "…in relation to zones formed through the circulation of technical practices and devices" (2001: 3). Lockwood et al. (2016) and Andrews-Speed (2015) note with regards to historical institutionalism and transitions that there is insufficient attention to the material implications of certain technologies in shaping institutional routines and practices that may influence the directionality of sustainability transitions. In the 1970s for example, calls for technological transitions were strongly driven not just by environmental evaluations, but by comparisons between 'soft' paths of renewables and energy efficiency as opposed to the 'hard' paths of centralised energy such as nuclear power (Lovins 1977). The idea was that the perceived secretive, centralised state-led practices associated with nuclear power could be displaced by more community and citizen oriented societal organisation centred around renewables and energy efficiency. Concerns around the *'plutonium economy'* (Flood and Grove-White 1976; Patterson 1984) and the *'nuclear state'* (Jungk 1979), highlighted how the security implications of plutonium meant that there was a necessary level of secrecy and non-transparency due to the nature of materials being handled which reduced democratic control. Other examples of how governmental practice was effected negatively by the need to safeguard particular technological commitments include 'entrapment' with regards to the reprocessing of nuclear waste (Walker 2000).

This focus sheds more light on the broader nature of the 'sustainability transition' in question, and the effects that the characteristics of certain technologies may have, where the materialities of technologies influence the democratic practices that shape the nature of the broader transitions 'contexts'. This is true with regard to the secrecy around nuclear power plants prohibiting fuller forms of public deliberation, or how energy systems organised around off-grid renewable energy are often less attractive to state elites because they are less amenable to rent-seeking. States elites often prefer energy sources that serve central grids and where they have a key role in negotiating contracts over access to fixed fossil fuel resources and securing a revenue stream. The flip side of this is to look at how the relationship between different spatial distributions of state power may or may not 'fit' with certain technological options. For example, the UK is considered a 'centralised' state in terms of the concentrations of power between cities, regions and the national level, compared to Germany and Denmark where there is considerably more devolution to regions and municipalities. This may have important consequences in terms of which technologies work within such a democratic settlement and those that may struggle to operate in such conditions. So understanding how forms of state governance are reproduced through certain 'objects of governance' (Brenner et al. 2009) as well as how established forms of spatial-institutional arrangements of the state interact with technological pathways, affords another potentially useful line of enquiry.

Such accounts of the different dimensions of state power can be usefully complemented by an emphasis on state practices: the technologies and governmentalities that states employ to manage energy, food and water systems for example. 'Seeing like the state' to use James Scott's expression (Scott 1998), implies understanding the logics of state visions, planning and modelling. It draws attention to how and why states manage uncertainty and risk in socio-technical systems in ways aimed at making challenges manageable, technical in nature and subject to predictable bureaucratic routines and existing procedures and away from conflictual public and political arenas over which they have less control. This is often at odds with calls for energy, food or water 'democracy' or the democratisation or opening up of debates about competing pathways to sustainability. In engaging with the idea of a 'transition state', where problems of societal transformation are reduced to planning and governance challenges, it is important to avoid the risk of taking at face value the appropriate object of study as well as distorting or biasing our understanding of where power lies. For example, locating it in the executive branch of the state rather than in a more dispersed and less territorially organised manner and failing to appreciate the extended basis

of state power which needs to be enrolled for transitions to take hold and be effective. This is significant in policy terms because it points to, and to some extent helps to explain, the mismatch between histories of transition and what we expect and assume of the state; how much can be controlled and directed from above and how far even sweeping economic transformations can be planned and brought into being by states. There was after all no state blueprint for the industrial revolution.

4. Conclusions

In this paper we have provided evidence of the need to widen the analytical lens in transitions thinking to incorporate and understand the multiple and diffuse forms of state power. At a minimum, a relational focus invites exploration of state-society complexes and the relations of power which underpin them which are not confined within bounded territories. It means not treating the state as an independent, atomised rational actor. Rather, it requires an appreciation that the state is not neutral with respect to the actors and processes it is charged with regulating (Saurin 2001). This is perhaps especially true with energy because of the nature of the aforementioned links to growth and militarism, the potential for state elites to secure rents from energy resources in the ways described by work on resource curses (Ross 2012) and the potential for lack of access to energy and revenues from energy to generate popular social unrest. Popular resistance to changes to fossil fuel subsidy regimes in many parts of the world (Lockwood 2015) illustrates clearly why state elites tread carefully when considering changes to the energy regime. However, similar arguments might be made about the close ties between land-owning classes in preventing rural transformations in land in many parts of the world or the fact that state elites often position themselves to capture the benefits of changes to the provision of key services like water through privatisation (Sjölander Holland 2005). Whichever way we look at it, the state is embroiled in deeper networks and structures of incumbent material and institutional power such that calls to challenge incumbent power necessarily imply a focus on the state.

The account we have provided here, drawing on literatures from a range of disciplines and making use of examples from a cross-section of sectors, regions and issue areas is necessarily tentative. It has engaged with a broad range of literature about the form and function of the state, demonstrating its relevance in relation to the study of transitions to sustainability and highlighting the limited systematic and theoretical attention dedicated to the state thus far. Showing why this is significant, we then made the case for a more historical, spatial and global, multi-dimension, relational and material account of the state and the social, political and economic relations and interdependencies of which it is a part. Engaging with these accounts helps to build bridges between transition studies and conceptualisations of the nature and role of the state in environmental policy developed by geographers, sociologists, and political economists reviewed in this paper. Such a bridge-building function, is consistent with the general trend in the field toward more interdisciplinary engagement with a variety of social science perspectives.

Each perspective offers a different entry point in understanding the complex task of unpacking the nature of the state in sustainability transitions. Historical accounts shine a light on the ways in which underlying political economic ideologies influence the kinds of regulations and interventions pursued by states, reflecting shifting attitudes towards the state and its relationship to the economy over time, and important historic state-society complexes that exist in particular transitions contexts that play a crucial role in setting the directionality of transitions. Global and spatial analyses of the state draw attention to the ways in which states are embedded in global institutions and networks of power which often constrain, but potentially also facilitate, interventions in relation to sustainability depending on where individual states sit within geometries of power in relation to multilateral actors such as the WTO and World Bank. A focus on multiple dimensions of the state highlights how broader state functions influence the trajectory of particular transitions, and confer power upon military-related or financial interests that may not be visible within a focus on regimes and niches. Relational understandings of the state, meanwhile emphasise how states are not monolithic actors abstracted from society, but are rather constituted by broader social power relations that constrain the kinds of state action that is possible in relation to sustainability transitions. Finally, material accounts reveal the interactions between technological pathways and differing state-institutional environments, focussing on how technologies may influence the forms of governance

arrangements pursued by the state (such as the levels of security and top-down oversight required to pursue a nuclear pathway).

Taken together, these approaches provide the means for enhancing our understanding of the politics and practices of statecraft, the prospects and limitations of state-led socio-technical transitions, as well as broader green transformations. These approaches offer a means of unpacking the differing ways through which the state is constituted which influences the kinds of actions and policies that states can pursue Vis-à-vis sustainability transitions. The aim of this paper has not been to provide a template or model regarding the role of state in transitions that can be applied *en tout* to cases of transition, but rather to contribute to discussions in sustainability transitions in which the state is treated in a more dynamic, relational and practice-oriented manner. This moves beyond discussions of whether the state is good or bad, whether change comes from the 'bottom up' or 'top down', to appreciating that the state in varying ways plays a variety of roles in sustainability transitions, both acting as an enabler and a barrier to transformations to sustainability. Comprehending the differing processes through which states are constituted contributes to broader agendas in sustainability transitions of understanding where crucial dynamics of power and political opportunities for promoting change reside that may not be readily visible when the conceptual priorities reside in niche-regime dynamics. In short, as well as considering what kind of role the state can play in enacting sustainability transitions, understanding the variety of ways in which the state is reproduced through differing social and material processes is a crucial first step. The five ways of conceptualising and understanding the role of the state presented here each offer an important starting point in appreciating the different kinds of processes through which the state is constituted and plays a crucial role. Our hope this is that this affords a richer starting point for future studies of transitions and the role of the state in enabling, as well as at times frustrating them.

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